

The background features a series of stylized, overlapping blue waves that flow from the left side towards the right. The waves are rendered in various shades of blue, from light to dark, creating a sense of movement and depth. The largest wave is a dark blue, while the others are lighter, creating a layered effect.

WCWC

**Walkerton
Clean Water Centre**

An agency of the Government of Ontario

Presence of Pharmaceuticals, Personal Care Products, and Pesticides In Water Supply

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Endocrine Disrupting Chemicals

Research has shown that some environmental pollutants can affect reproductive hormone levels and reproductive tissues in fish.

Chemicals that can alter hormone levels that control growth, reproduction and development are considered Endocrine Disrupting Chemicals.

Endocrine Disrupting Chemicals

“Environmental chemicals that interact adversely with glands and hormones that control or regulate many biological processes” (USEPA, 1998)

Pharmaceuticals and Personal Care Products

Pharmaceuticals;

- ❖ Generally used to treat symptoms
- ❖ Improved and expanded human life
- ❖ Used for veterinary & Agricultural purposes

Personal Care Products;

- ❖ Shampoos, Fragrances
- ❖ Herbal Remedies, etc.

Classification of common pharmaceuticals and EDCs found in the environment

Classification	Compounds	
Analgesics and Non-steroidal anti-inflammatory drugs	Acetaminophen (paracetamol)	Indomethacin
	Acetylsalicylic acid	Ketoprofen
	Codeine	Meclozine sulfosalicylate
	Diclofenac	Naproxen
	Fenoprofen	Phenazone
	Ibuprofen	Propyphenazone
Antibiotics	Amoxicillin	Roxithromycin
	Chloramphenicol	Sulfachloropyridazine
	Chlortetracycline	Sulfadiazine
	Ciprofloxacin	Sulfamerazine
	Doxycycline	Sulfamethazine
	Erythromycin	Sulfamethizole
	Lincomycin	Sulfamethoxazole
	Monensin	Tetracycline
	Oxytetracycline	Trimethoprim
	Penicillin G	Virginiamycin M1

Classification of common pharmaceuticals and EDCs found in the environment

Veterinary Antibiotics	Lasalocid A	Sulfadimethoxine
	Carbadox	Tylosin
Anticoagulant	Warfarin	
Antidepressant	Diazepam	Fluoxetine
Antiepileptic	Carbamazepine	Primidone
Blood Lipid Regulators	Bezafibrate	Gemfibrozil
	Clofibric Acid (from clofibrate)	Fenofibric acid (from fenofibrate)
Endocrine Disrupting Compounds	Bisphenol A (BPA)	Perfluorooctanoic Acid (PFOA)
	Nonylphenol	Perfluorooctyl Sulfonate (PFOS)
	Octylphenol	
Natural and Synthetic Steroids	17 α -estradiol	Equilin
	17 α -ethynyl Estradiol	Estrilol
	17 β -estradiol	Estrone
	19-norethisterone	Progesterone
	Diethylstilbesterol	Testosterone

Health Effects

Since medical drugs are designed with a specific mode of action, it is expected that they may have a variety of effects on non-target receptors and can possibly cause adverse effects in a target organism. Antibiotic resistance is the issue receiving the most attention of all the PPCPs, especially since a large portion of antibiotics leaves the body and end up in receiving waters. We do not know what threshold levels are toxic, especially in complex mixtures.

Health Effects

Effects on wildlife have been documented from PPCPs in surface waters. In Lake St. Clair, upstream from the City of Windsor's drinking water intake, male fish have been found to have eggs. This is suspected to have occurred from exposure to endocrine disrupting chemicals. Studies in the United Kingdom and United States in the 1990s indicated reproductive abnormalities in fish living below wastewater treatment plants.

Health Effects

It is speculated that EDCs may be responsible for declining sperm counts and decreased sperm motility and function in the human population. EDCs may cause adverse effects including hormone dependent cancers, reproductive tract disorders, and reduction in reproductive fitness.

Neutral Drugs and Atrazine Identified in STP Effluent



Note 1: Site 1, STP effluent; Site 2, Little River/Detroit River confluence; Site 3, Downstream of combined sewage overflow (CSO); Site 4, Reaume Park; Site 5, Raw water intake of WUC.

Note 2: the concentrations are averages of 3 samples (Hua et. al 2003).

Detection of PPCPs and EDCs in surface waters (ng/L)

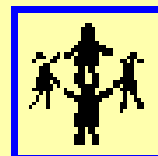
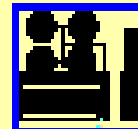
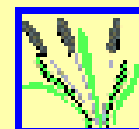
Bezafibrate	10	SW*	Hamilton Harbour, Canada	Metcalf et al. (2003)
Carbamazepine	23	SW	Hamilton Harbour, Canada	Metcalf et al. (2003)
Clofibric Acid	1	SW	Hamilton Harbour, Canada	Metcalf et al. (2003)
Ibuprofen	27	SW	Hamilton Harbour, Canada	Metcalf et al. (2003)

* Sewage Water

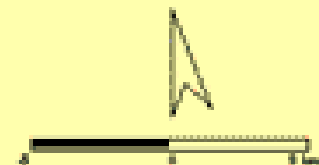
Detroit



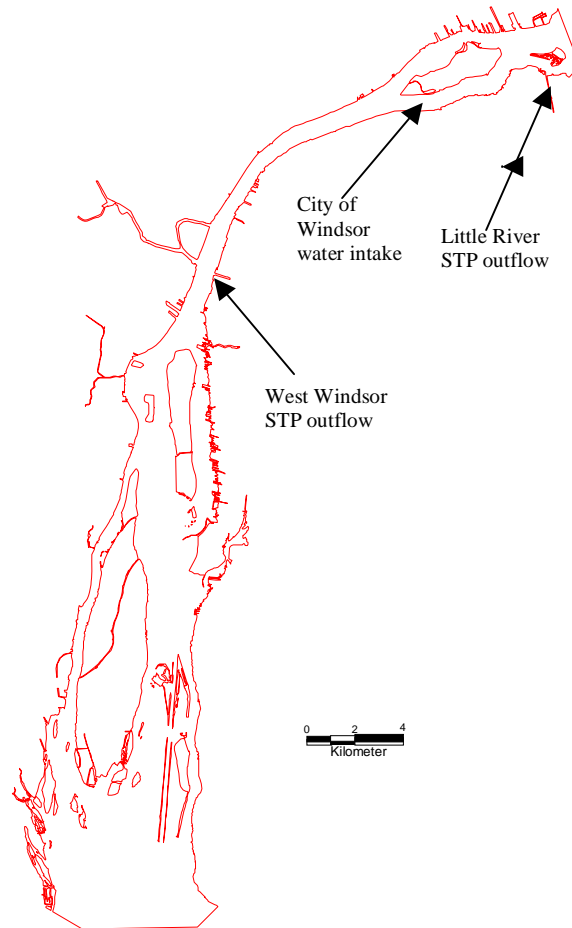
[Select an icon to view actions underway](#)



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Location of Windsor's water intake and STP outflows in the Detroit River



PPCPs Study Partners

- ❖ Windsor Utilities Commission
- ❖ AWWARF
- ❖ International Joint Commission
- ❖ City of Detroit, Michigan
- ❖ Ontario Ministry of the Environment
- ❖ University of Windsor
- ❖ Oakland University, Rochester, MI
- ❖ Health Canada
- ❖ Earth Tech Canada
- ❖ Centre of Environmental Health of Ontario

Existing Knowledge

- ❖ In 2002, samples were collected from the pilot plant and analysis was conducted by Tulane University
- ❖ Trace levels of colibacillic acid, Bisphenol A, and naproxen were detected in raw water samples only
- ❖ The findings of that study confirm the presence of pharmaceuticals in Detroit River raw water

March 2002 Result

			Blank	RAW	F1	F2	A.H. Weeks
	RT	Q1	ng/L	ng/L	ng/L	ng/L	ng/L
Clofibric Acid	17.58	128	ND	103	ND	ND	ND
Ibuprofen	19.49	263	ND	ND	ND	ND	ND
Acet-d4*	19.68	284	ND	ND	ND	ND	0.17
Acetaminophen	19.74	280	ND	ND	ND	ND	ND
Caffeine	27.32	194	ND	ND	ND	ND	ND
Fluoxetine**	27.83	104	ND	ND	ND	ND	ND
Clorophene**	29.9	275	ND	ND	ND	ND	ND
Naproxen	30.74	243	ND	63	ND	ND	ND
Triclosan	31.29	200	ND	ND	ND	ND	ND
Bis-d14*	32.04	368	90.62	66.68	80.19	91.48	93.57
Bisphenol A	32.13	357	26	NQ	NQ	NQ	NQ
Est-d4*	36.18	346	84.33	77.21	82.14	74.62	90.7
Estrone	36.21	342	ND	ND	ND	ND	ND
17B-Est	36.39	285	ND	ND	ND	ND	ND
Cholesterol	40.33	329	6.3	6.3	6.3	11.3	1.8

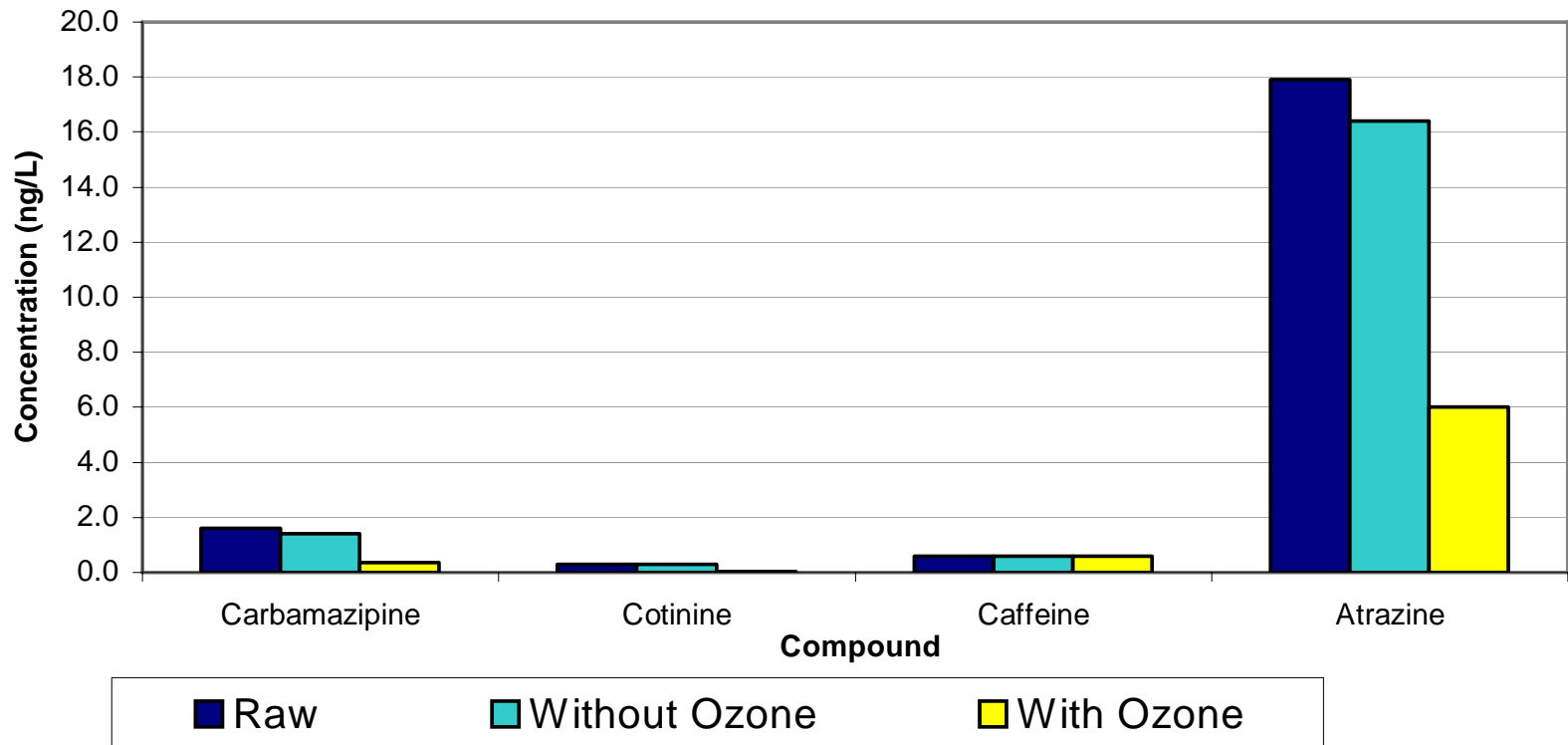
* % Recovery of Surrogate Standard

**Not Quantitative

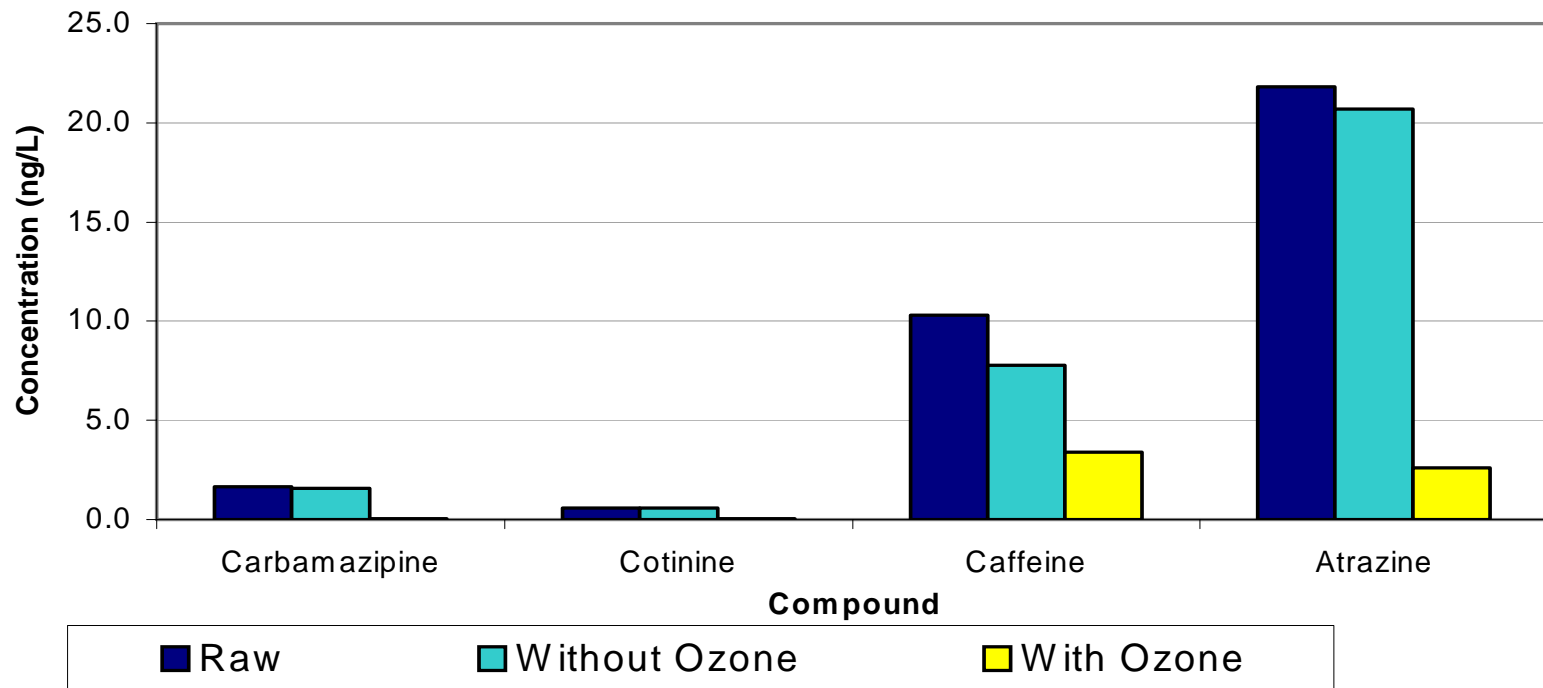
Results & Discussion

During the sampling period from September 2002 to June 2003, the analysis were conducted by the University of Windsor. The analysis indicated the presence of certain compounds in Detroit River water, such as Carbamazepine, Cotinine, Atrazine and Caffeine

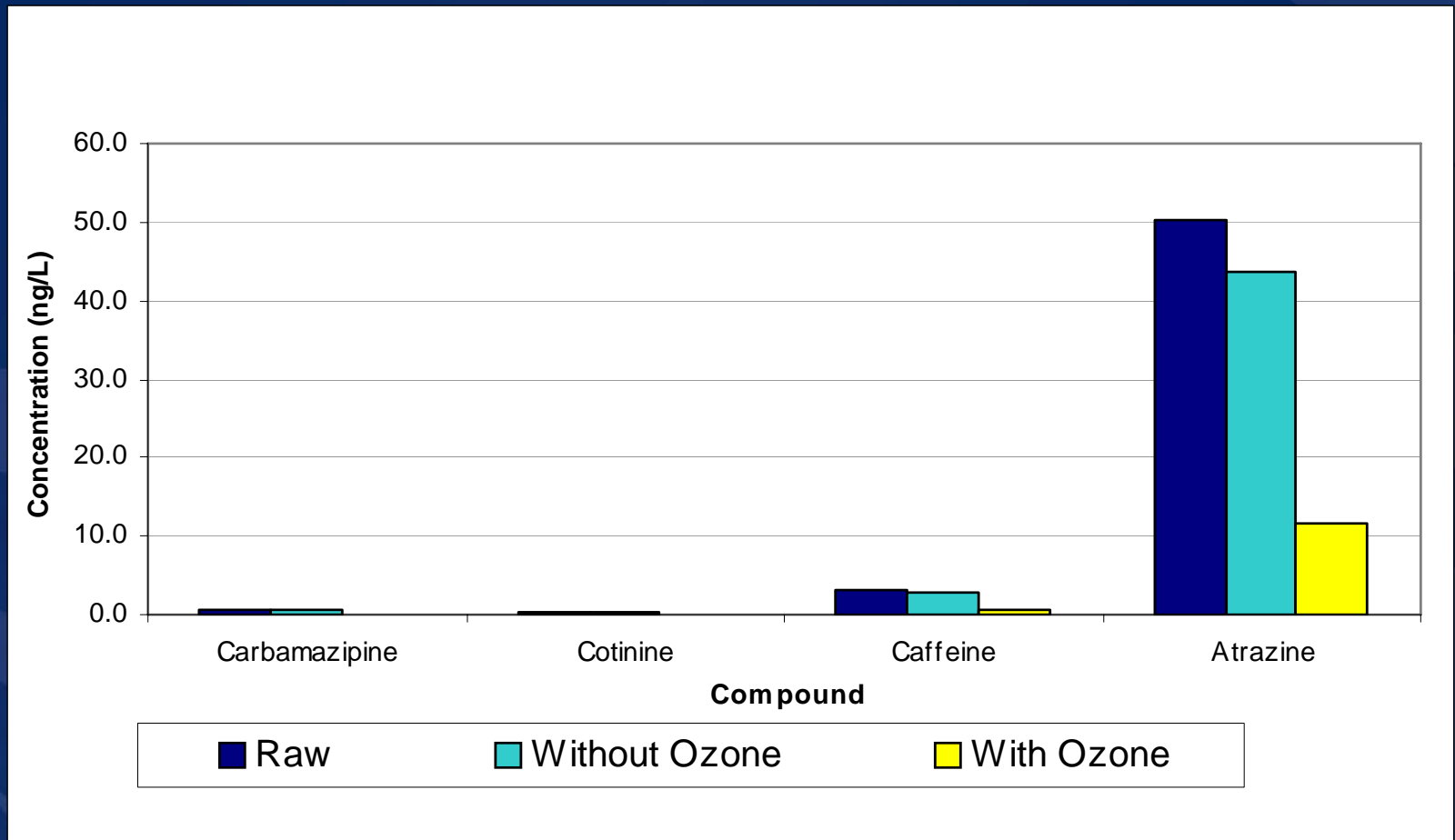
Average for Compounds in Raw Water and Filters Effluent, September 2002



Average for Compounds in Raw Water and Filters Effluent, April 2002



Average for Compounds in Pilot Plant Raw Water and Filters Effluent, June 2003



Recommended Objectives of Future Studies

- ❖ Identification and determination of the seasonal loading and dynamics of major acidic and neutral PPCPs and pesticides in the discharge of Sewage Treatment Plants into Great Lakes water
- ❖ Fate and Transport: The fate and transport of the EDCs and PPCPs from their point of discharge to other destinations. These pollutants can enter the watercourse by a variety of mechanisms, including sewage treatment plants discharge, combined sewer overflow, or non-point source contribution such as storm water runoff.